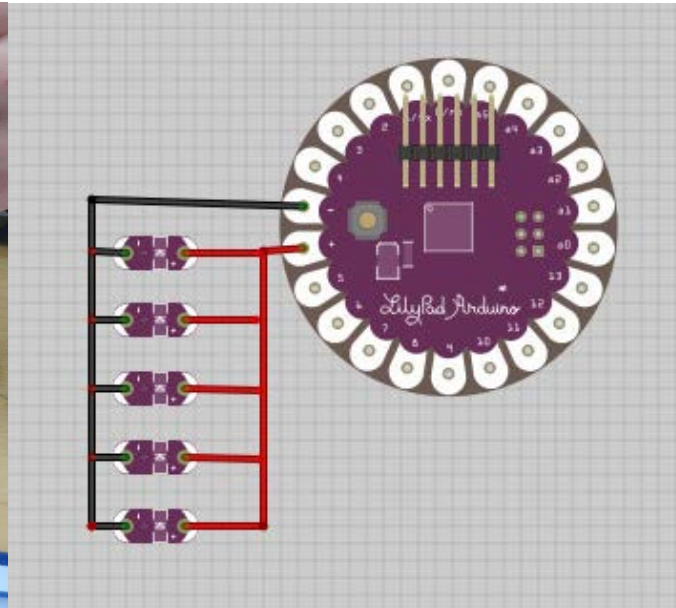


Smart textile as a context to support computational thinking



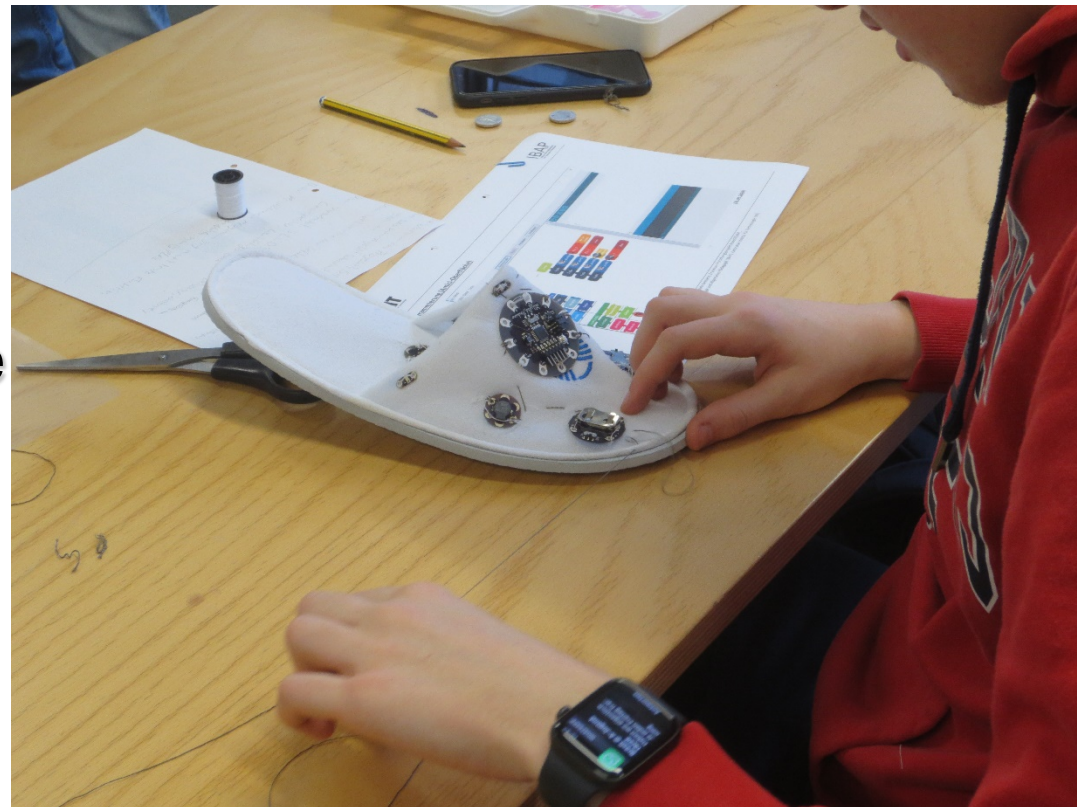
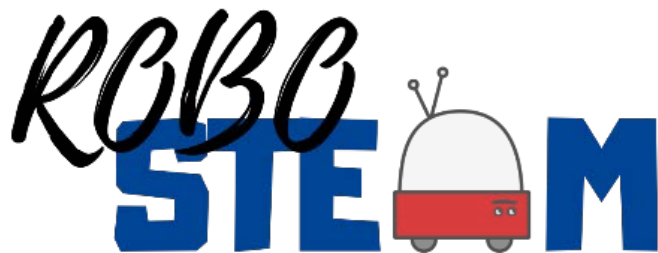
Daniela Reimann,
bringing together creative processes to support computational thinking in the classroom,
in the Erasmus+ ROBOSTEAM project



Seminar connected to the school project

Media literacy: Challenge and design based learning and teaching by developing robotic Objects at school (RoboSTEAM)

In collaboration with the
Carl Benz School Karlsruhe



Participating students

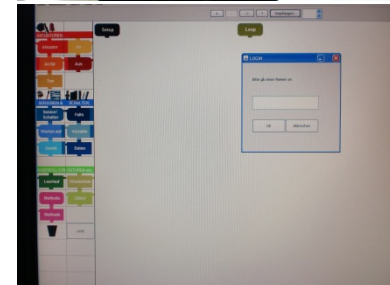
5 BA-Students of engineering pedagogy, KIT

1 MA-Student of engineering pedagogy, KIT

**17 school pupils/ apprentices of metal engineering,
Carl Benz school**

Role of the students

1. Development of school project including all prerequisites and conditions (STEAM surveys, Quiz, observation, co-measure observation)
2. Moderation of lessons
3. Supervising /mentoring working groups of pupils



seminar requirements

1. Didactic approach and potential of Smart Textile for Learning science
2. Hands-on skills: Hard- und Software, objekt design
(construction, wiring; programming)
3. Planning and moderating of lessons
4. Mentoring a working group of pupils and observing them with the observations sheets

Number of sessions

- 7 Blocks at KIT/ IBAP/ Westhochschule,
Fridays, 10 a.m.-13 p.m.
18.10.2019, 25.10.; 8.11.; 15.11. 29.11. 13.12, 20.12.
- 5 Blocks At Carl Benz School, Karlsruhe, Steinhäuser
Str. 23: jeweils Friday , 9.15 a.m. -12.30 a.m.
10.1.2020, | 17.1. | 24.1. | 31.1. | 07.2.

1. Introduction to
2. the RoboSTEAM project and the concept of computational thinking
3. challenge based learning and collaborative prototyping with Arduino LilyPad technology
4. Hands on Arduino and Amici
5. lesson planning
6. mentor lessons
7. observation of pupils
8. how to use the observations sheets

- Design-oriented teaching and learning concept for the promotion of media education and understanding of technology and computer terms (algorithm, if-then condition structure)
- Issue of challenge based learning approach of the project and its application in the context of wearables
- Making the abstract model tangible : Media practice: Smart textile examples
- Identify hardware components, structure and pins
- Software programming environment, interface, functionalities,
- First tasks with informatics concepts (If...then; Loop)
- Sewing of joints is still pending

Vorgaben des Projekts für die Unterrichtsplanung

Der Rahmen umfasst:

- specifications of the project for lesson planning:
- Interviewing the pupils who are not involved
- Survey of the participating pupils (attitude towards STEAM subjects)
- STEAM test after implementation
- Conducting a Partner Challenge
- Co-Measure /Measurement of collaboration activities (by teachers)

Concepts of computer science

which will be addressed later in the test:

If/else /if...then conditionality

if condition, then instruction(s); end

Loops / Loops

control structure, repeat an instruction block as long as the sequence condition is valid

Survey

Attitude towards

STEAM

■ → how to translate it!

Science/Natur-wiss.

To me, SCIENCE is:

Instructions: Choose one value between each adjective pair to indicate how you feel about the object

•

	1	2	3	4	5	6	7	
Fascinating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Ordinary

•

	1	2	3	4	5	6	7	
Appealing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Unappealing

•

	1	2	3	4	5	6	7	
Exciting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Unexciting

•

	1	2	3	4	5	6	7	
Means nothing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Means a lot

•

	1	2	3	4	5	6	7	
Boring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Interesting

Mathematical and scientific subjects (MINT)

- Biologie. Informationen und Materialien zum Fach Biologie in allen Schulformen und für alle Schulstufen. ...
- BNT. Biologie, Naturphänomene, Technik; Klassenstufen 5 und 6. ...
- Chemie. Chemie. ...
- Informatik. Informatik. ...
- Mathematik. Mathematik. ...
- MNT. Fächerverbund Materie - Natur - Technik. ...
- Physik.
- Sciences that work empirically and are concerned with the study of nature. ... The natural sciences include astronomy, physics, chemistry, biology, and some environmental sciences such as geology, but also agricultural sciences.

Maths

To me, MATHS is:

Instructions: Choose one value between each adjective pair to indicate how you feel about the object

•

1 2 3 4 5 6 7

Boring Interesting

•

1 2 3 4 5 6 7

Appealing Unappealing

•

1 2 3 4 5 6 7

Fascinating Ordinary

•

1 2 3 4 5 6 7

Exciting Unexciting

•

1 2 3 4 5 6 7

Means nothing Means a lot

Engineering

To me, ENGINEERING is:

Instructions: Choose one value between each adjective pair to indicate how you feel about the object



•

1 2 3 4 5 6 7

Appealing Unappealing

•

1 2 3 4 5 6 7

Fascinating Ordinary

•

1 2 3 4 5 6 7

Means nothing Means a lot

•

1 2 3 4 5 6 7

Exciting Unexciting

•

1 2 3 4 5 6 7

Boring Interesting

Arts

To me ARTS, is:

Instructions: Choose one value between each adjective pair to indicate how you feel about the object:

1 2 3 4 5 6 7

Exciting Unexciting

1 2 3 4 5 6 7

Fascinating Ordinary

1 2 3 4 5 6 7

Means Nothing Means a lot

1 2 3 4 5 6 7

Boring Interesting

1 2 3 4 5 6 7

Appealing Unappealing

Technology

To me, TECHNOLOGY IS:

Instructions: Choose one value between each adjective pair to indicate how you feel about the object.



1 2 3 4 5 6 7

Appealing

Unappealing



1 2 3 4 5 6 7

Means nothing

Means a lot



1 2 3 4 5 6 7

Boring

Interesting



1 2 3 4 5 6 7

Exciting

Unexciting



1 2 3 4 5 6 7

Fascinating

Ordinary

Career in STEAM

To me, a CAREER in science, technology, engineering, arts or mathematics (is):

1 2 3 4 5 6 7

Means nothing Means a lot

1 2 3 4 5 6 7

Boring interesting

1 2 3 4 5 6 7

Exciting Unexciting

1 2 3 4 5 6 7

Fascinating Ordinary

1 2 3 4 5 6 7

Appealing Unappealing

ZURÜCK

SENDEN

Seite 7 von 7

The quiz was introduced in physical space

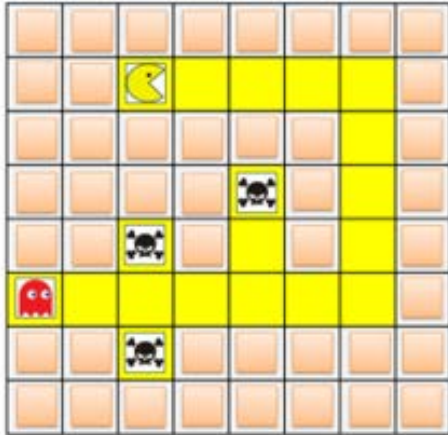
By controlling a real student and navigate him through the classroom. Therefore the prepared the floor using lines of stripe



Test/Quiz nach Durchführung

IF/ELSE

¿Qué órdenes llevan a 'Pac-Man' hasta el fantasma por el camino señalado?



Opción A

```

Repetir hasta llegar a...
hacer
  si hay un camino delante
  hacer avanzar
  sino girar a la izquierda
  
```

Opción B

```

Repetir hasta llegar a...
hacer
  si hay un camino delante
  hacer avanzar
  sino girar a la derecha
  
```



Opción C

```

Repetir hasta llegar a...
hacer
  si hay camino a la derecha
  hacer girar a la derecha
  sino avanzar
  
```

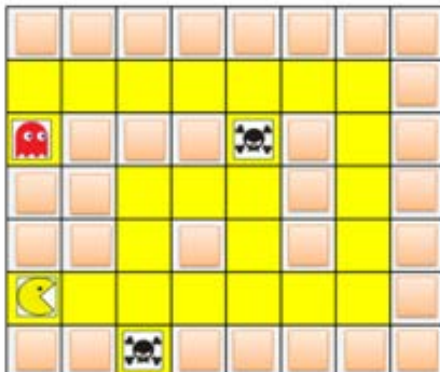
Opción D

```

Repetir hasta llegar a...
hacer
  si hay camino a la izquierda
  hacer girar a la izquierda
  sino avanzar
  
```

game approach, Quiz, rather than assessment

¿Qué órdenes llevan a 'Pac-Man' hasta el fantasma por el camino señalado?



Opción A

Repetir hasta llegar al fantasma [Si hay camino delante(Avanzar) | Si no(Girar a la derecha)]

Opción B

Repetir hasta llegar al fantasma [Si hay camino delante(Avanzar) | Si no(Girar a la izquierda)]



Opción C

Repetir hasta llegar al fantasma [Si hay camino a la derecha(Girar a la derecha) | Si no(Avanzar)]

Didaktik?

WHAT: What learning content is selected from the range of possible learning materials (and why)?

and:

How to?: Which methods are used to convey the learning content in the best possible way (e.g. playful, quiz, competition) and why?

Which social forms are selected (e.g. group work, individual work, impulse lecture, ...) and why?

Didactic-methodical lesson planning and justification

Present importance, future importance, exemplary importance of learning content (Klafki)

Learning process- accompaniment



Bauer et al. (ILIAS)

[http://www.gab-
muenchen.de/de/downloads/lernbegleitung_in_derpraxis_v2.pdf](http://www.gab-muenchen.de/de/downloads/lernbegleitung_in_derpraxis_v2.pdf)

Basic attitude of a learning process facilitator

- Respect for learners
- Helping people to help themselves
- Moderating attitude (restraint)
- awareness that people learn throughout their lives
- Nobody deliberately makes mistakes
- Mistakes are for learning, open up learning opportunities
- Create a learning situation and avoid disturbances
- Learning processes require time and patience
- Show interest in the subject and pupils

Lesson planning: What needs to be planned?



Tool „Tabular course planning“

Time frame from to time/ time unit
Group... Lessons on...

Time	Phase	Teacher behaviour	Expetected Pupils' behavior	Social form	Media	Lerning goal
In Minuten/ 15' Von 8.30- 8.45 ...Anfang s-zeit... bis...	Motivation	z.B. Input, Aufgabenstell ung, Erläuterung,	Mit welchem Verhalten der Lernenden ist zu rechnen?	Findet Gruppenarbeit, Einzelarbeit oder TN- Dozenten- gespräch statt?	Welche Medien werden in dieser Phase benötigt?	Kennen- lernen der Medien

Rough lesson planning, appointments, AG, moderation /Who does what?

- **10.1. : Introduction project + plan, getting to know each other, playful questioning, show EF Smart textile:**
 - have it explored, get to know components, wiring the circuit
- **17.1. : Practice: What is programming? Unplugged: Informatics concepts " If, then" "loops", EF Software amici example task LED on/off, topic for project work,**
- **24.1., Theme for project work, task Koop. Prototype development (e.g. inventions),**
- **31.1 Group work, support (all)**
- **07.2. completion of group work, presentation and group discussions (test questionnaire), feedback**

Identifying themes for projects with the KIT students

- Topics for the pupils' project work (prototype development)
- Brainstorming in groups/flipchart
- Which topic is suitable and why?

Presentation of results

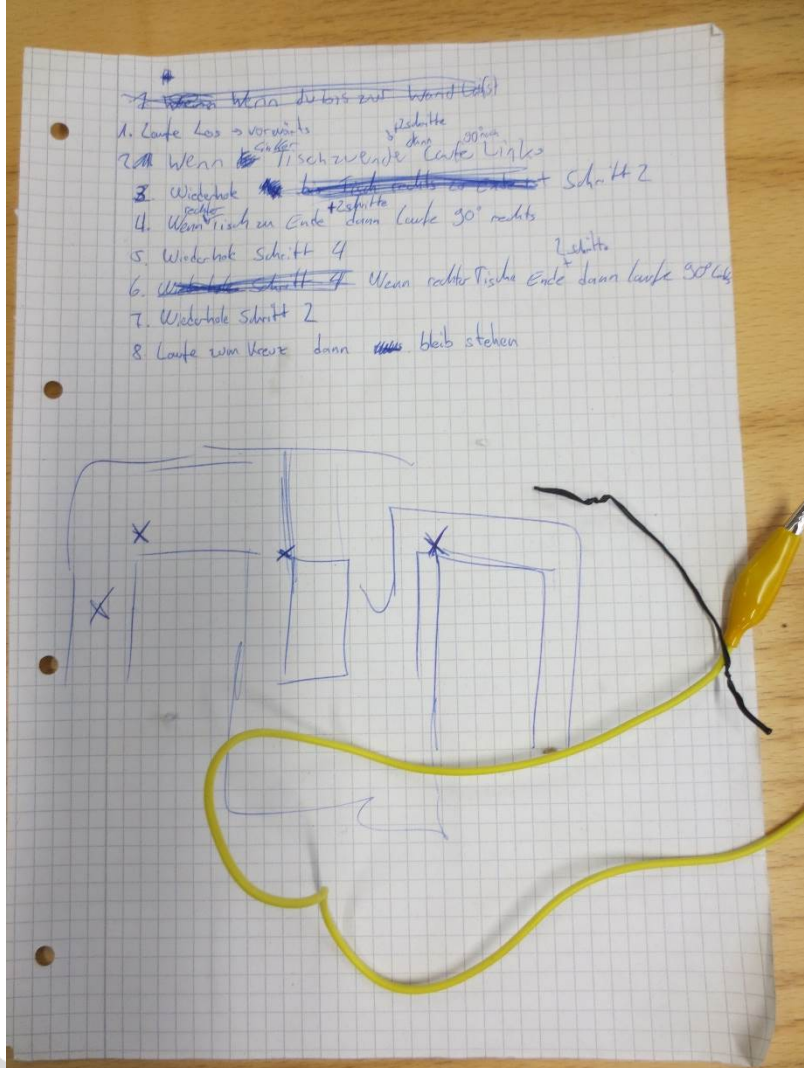
- Smart clothes can do more (than non-smart clothes)

Lesson plan, example



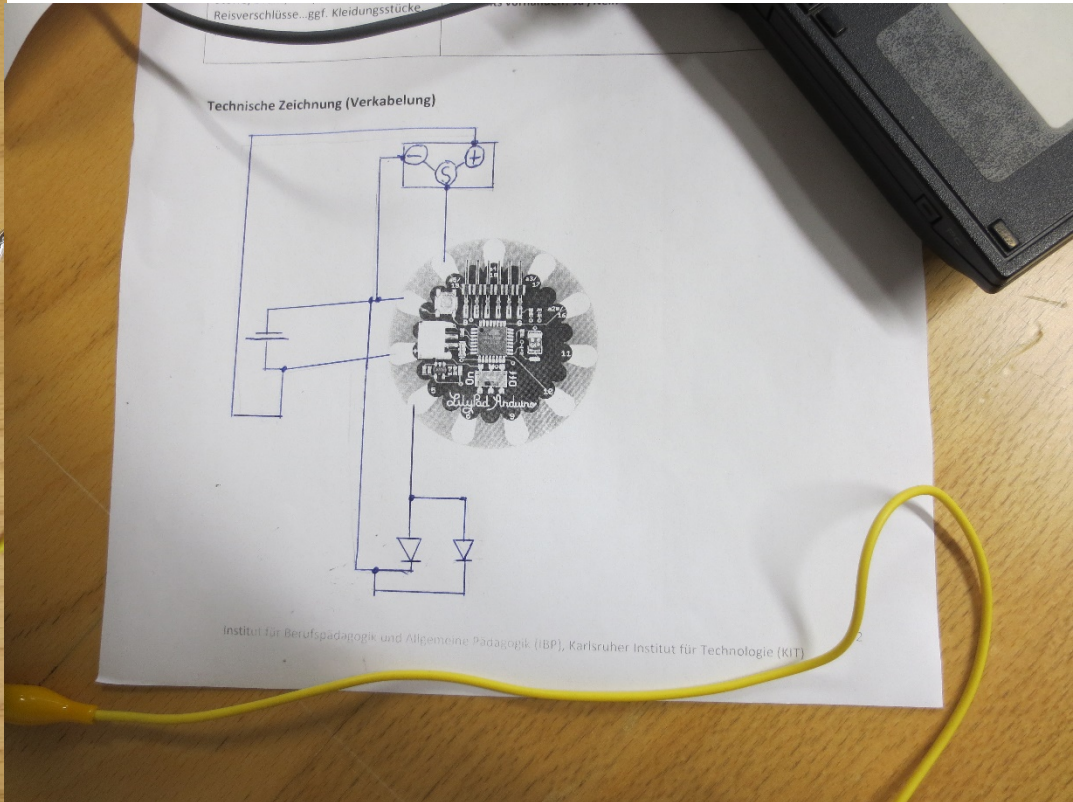
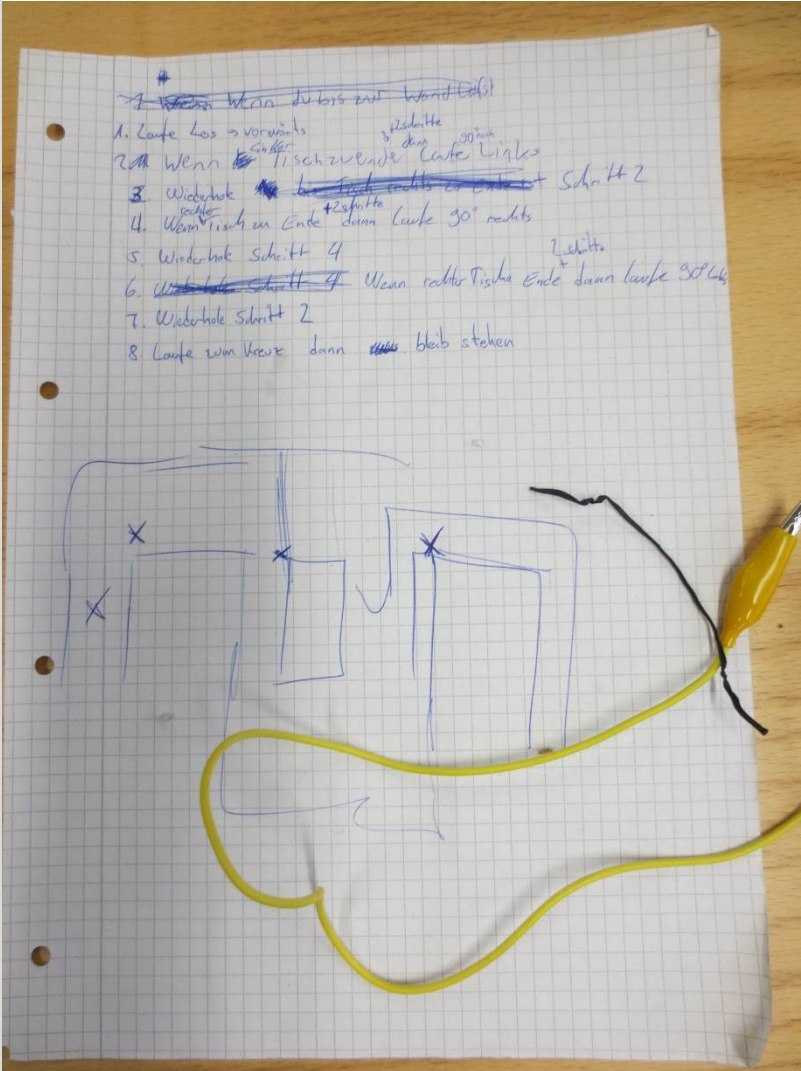
Zeiteinheit und Uhrzeit	Phase	Lehrerverhalten, ggf. Arbeitsaufgabe ausformulieren	Erwartetes Schülerverhalten	Sozialform	Medien und Materialien	Ggf. Lernziel
15-20 ‘ 09.15-09.20	Begrüßung und Vorstellung des Schulprojekts und der kommenden Schultermine, gegenseitiges Kennenlernen	Dozenten stellen sich vor, fordern Schüler auf, sich auch vorzustellen				
10.10-10.30	Einstieg Motivationsphase					
10.30-11.10	Input Hardware			Gruppenarbeit – 2-3 Gruppen mit 2-3 Studenten		
11.10-13.00	Erarbeitungsphase	Dozent formuliert die folgende Aufgabenstellung sowie die Zeit, die die Schüler für die Bearbeitung zur Verfügung haben:			Arbeitsblatt	

- **G1 Einführung** Projekt + Vorhaben, gegenseitiges Kennenlernen, Spielerische **Befragung/Quiz**
- **G2 EF Smart textile**. Komponenten kennen lernen, Schaltkreis verkabeln...
- **30 min**
- **Anregungen auch TACCLE3.eu/**



All students received a portfolio to collect the work sheets to develop their prototype collaboratively

Portfolio: Collection of work sheets accompanying the process of collaborative prototyping



Examples of prototypes



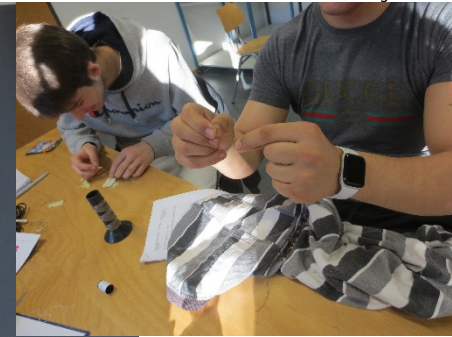
Example of prototypes



Examples of prototypes



Examples of prototypes



Examples of prototypes



Final block presentation of results



Evaluation

- Observation of pupils

The university students were introduced to the topic of „how to observe single pupils of a working group“



Observation sheet (figure detail)

(validated in the BMBF-research project MediaArt@Edu project)

Evaluation criterion	Indicator	Not observable	Grade/mark					
			Strongly pronounced - not available					
			1	2	3	4	5	6
Media Technology: Hardware								
Sensor- and Aktuator based System development: Wiring	Pupil is able to correctly wire the required components of an interactive system							
Programming /Computational modeling: Software (AMICI)								

Developing a program/computational model in AMICI	Pupil is able to create the required program self-reliantly with the software	
Processing of problems of the program in AMICI	Pupil is able to solve programming problems	
Testing and revision of a program model in AMICI	Pupil is able to test and revise a program in AMICI	

Competence only becomes visible through acting, and acting is observable

Interim results

- High appreciation of student mentors
- All working groups developed a prototype concept and worked together on the realisation.
- For time reasons most prototypes could not be finalized by the pupils, since the quiz/test had to be done in the final session as well. Thos was also due to the KIT students missing experience in lesson planning
- The motivation was quite high in the beginning
- The introduction of the STEAM surveys and test (quiz) were very time consuming with a given number of 5 blocks altogether to realize a prototype

Change due to COVID 19 measures

- **The multiplier event** was planned in collaboration with the CENTRE FOR SCHOOL QUALITY AND TEACHER TRAINING [ZSL], the Regional Office Karlsruhe of the government headquarters in Karlsruhe.
- It was published as an **official teacher training** with clearly defined learning goals, consisting of a presentation of theoretical concept of RoboSTAM's approach, computational thinking and challenge based learning as well as good practice results of the school project and a hands-on workshop.
- Due to the Corona-Developments, the multiplier event could not take place at KIT as planned to take place on **July 6 2020**.

Multiplier event (planning for January 2021)

However, it was postponed and changed to take place **in collaboration with the Beo network for vocational orientation** of the city youth committee (Stadtjugendausschuss e.V. Karlsruhe, Gabi Matusik, head of BeoNetzwerk , Kronenplatz 1, 76133 Karlsruhe)

- It will take place in the week **18 -22 January -25 to 29 January.**
- Therefore 2 meetings with 10 participants of the Beo network and 2 different schools will be held, according to the Corona rules at KIT.

Thank you very much.

If you have any questions , please contact me at
Daniela.Reimann@kit.edu